

Dynamic Windows for California Zero Energy New Homes

Christian Kohler and Josh Apte

**Windows and Daylighting Group
Lawrence Berkeley National Laboratory
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windows.lbl.gov

Energy Star Windows

- Lead codes (although lead continues to diminish, behind in some areas)
 - Appropriate for E* homes
 - A drain for ZENHs
 - Low-e, Argon, insulating frames are near limit
 - Further improvements require technology leap
 - Significant energy savings possible beyond EnergyStar technologies
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Future zero energy windows??



Dynamic Window

- **Design Concept**

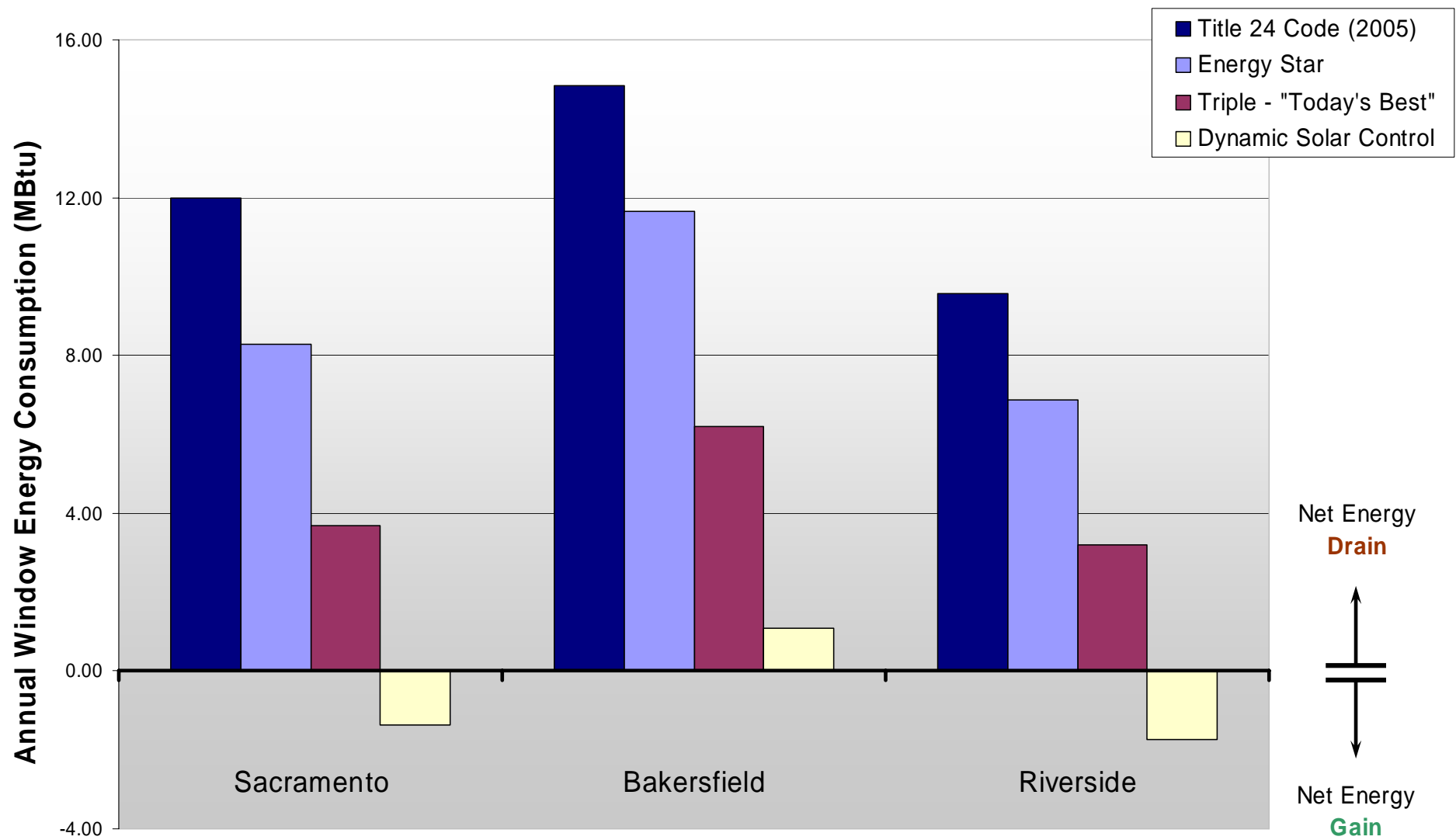
- Maximize solar gain when heating is needed.
- Block solar gains to minimize peak and reduce cooling energy.
- Turns windows from energy drain to energy gain – better than no windows!

- **Prototype**

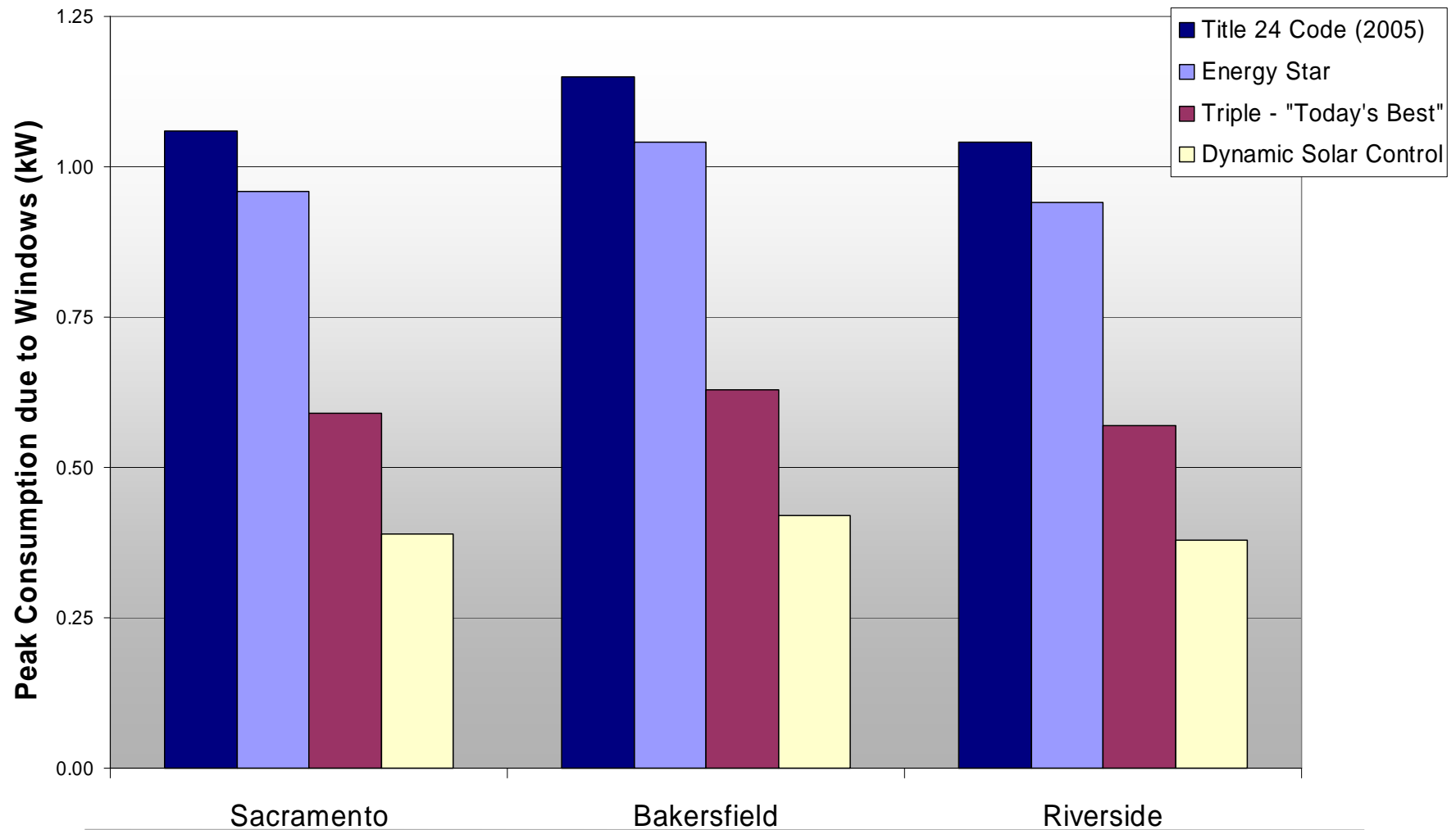
- Existing window with fabric shade.
- Modified with motor, sensors and controls to create a smart, standalone window.



Annual HVAC Energy Consumption of Windows



Peak HVAC Demand from Windows



Dynamic Windows: Improving from Title 24 (2005)

- **Prototype dynamic window would...**
 - Reduce whole house HVAC energy by 35% annually.
 - Reduce **total** household energy consumption by 10 – 15% annually.
 - Reduce household HVAC peak loads by 25%, saving 0.6 kW.
 - **Envelope is a prime candidate for improvement**
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Conclusions

- **High potential for “Zero Energy Windows”**
 - **New Window Technologies required for ZENH**
 - **Some products can be custom built today; some are still under R&D; possibilities for ZENH.**
 - **Advanced windows coupled with intelligent architecture offer greatest possible savings**
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Contact information

Christian Kohler

CJKohler@lbl.gov

510.486.5040

Josh Apte

JSApte@lbl.gov

510.486.5629

<http://window.lbl.gov>

<http://window.lbl.gov/projects/dynamicshades/>
